

REMARKS

**Status of the claims:**

Claims 1 and 4 are amended herein and new claims 10 and 11 are added. Claim 2 was previously cancelled without disclaimer or prejudice. Claims 1, 3-11 are present for examination.

Amendments to claim 1 are disclosed in the original specification, for example, on page 6, line 8 to page 7, line 17. Amendment to claim 4 are disclosed in the original specification, for example, on page 1, lines 9 to 11. New claims 10 and 11 are added and are. Thus no new matter is added.

**Claim rejection under 35 U.S.C. 103 (a):**

Claims 1 and 3-9 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Hoshizaki et al. (5,922, 651, hereinafter Hoshizaki et al.) in view of Okamoto et al. (JP-62157641) and further in view of Kobayashi et al. (6,993,823, hereinafter Kobayashi et al.).

Current claims are generally related to superconductors such as superconducting wires, increasing the thickness of the superconducting layer has been studied in order to increase the critical current.

Amended claim 1 recites, among other features,

a superconductor wire, comprising the step of forming a superconducting layer on a base layer by performing a film deposition at least three times without substantially changing an oxygen gas pressure between the at least three times, wherein the oxygen gas pressure is below atmospheric pressure, wherein a film thickness of a superconducting film made in each film deposition is 0.3  $\mu\text{m}$  or less and the superconducting layer having a layer thickness of 0.75  $\mu\text{m}$  to 3  $\mu\text{m}$  is formed on the base layer and wherein the base layer is composed of a substrate or composed of the substrate and a buffer layer disposed thereon, wherein either case, a portion of the base layer adjacent to the superconducting layer has a biaxial orientation, the substrate is composed of Ni, Cr, Mn, Co, Fe, Pd, Cu, Ag, Au or an alloy composed of at least two of Ni, Cr, Mn, Co, Fe, Pd,

Cu, Ag or Au, and the buffer layer is composed of a metal oxide containing at least one metal element having a crystal structure a pyrochlore-type, a fluorite-type, a rock salt-type, or a perovskite-type.

Amended claim 4 recites a superconducting wire having similar features.

Neither Hoshizaki et al. nor Okamoto et al. nor Kobayashi et al. teach, suggest or render predictable the features recited in amended claims 1 and 4. In particular, the cited references fail to disclose i) film deposition performed without substantially changing an oxygen gas pressure between the film deposition steps, ii) the base layer having a biaxial orientation, iii) a superconductor wire and iv) a critical current greater than 250 A/cm as recited in new dependent claims 10 and 11.

**i) Film deposition performed without substantially changing oxygen gas pressure between the film deposition steps.**

The Examiner acknowledges that the combination of Hoshizaki et al. and Okamoto et al. fails to disclose performing the deposition without substantially changing the oxygen gas pressure between the depositions. (Office Action of March 02, 2007; page 3, lines 4-5). The Examiner further asserts that Kobayashi et al. disclose maintaining a constant pressure in the oxygen during deposition to for a stable oxide superconducting layer. (Office Action of March 02, 2007, page 3, lines 5-8). However, Kobayashi et al. fail to disclose a film deposition method as recited in claims 1 or the superconducting wire as recited in claim 4. Kobayashi et al. instead discloses a wire formed by covering raw material powder of an oxide superconductor with a metal, the wire is heat treated in a pressurized atmosphere. (Kobayashi et al., column 2, lines 19 – 22). No film deposition occurs in Kobayashi et al.'s heated, pressurized atmosphere.

In addition, Kobayashi et al. fail to teach or suggest or render predictable the oxygen gas pressure is below atmospheric pressure. Instead, Kobayashi et al. teaches using a pressurized atmosphere at least 1 MPa and less than 50 MPa. (Kobayashi et al., column 2, lines 22-24, column 6, lines 50-52, lines 64-64, column 7 lines 34-35). Kobayashi et al. teaches a method of manufacturing an oxide superconducting wire by using raw material

powder of an oxide superconductor and heat-treating the wire in a pressurized atmosphere. (Kobayashi et al., Abstract). Thus, Kobayashi et al.'s process does not involve film deposition, but instead uses a powdered material and a pressurized, heated environment to transform the powdered material into a wire. Because Kobayashi et al. fail to teach film deposition, one of ordinary skill in the art would not look to Kobayashi et al. for modifying the deposition process of Hoshizaki et al. or Okamoto et al. Each of Hoshizaki et al. and Okamoto et al. references describe a deposition process which would not involve heat treating a powdered material in a pressurized environment. There would be no reason to use Kobayashi et al.'s heated, pressurized environment (which Kobayashi et al. uses to transform powdered material into a wire) in a deposition process (of Hoshizaki et al. and Okamoto et al.) in which material is deposited in a thin film.

Moreover, Kobayashi et al. teaches to use a pressurized atmosphere and, thus, teaches away from using pressure below atmospheric pressure. Therefore the combination of Hoshizaki et al. and Okamoto et al. and Kobayashi et al. do not make claims 1 and 4 obvious to one of ordinary skill in the art and thus claims 1 and 4 are believed to be allowable.

Next the Examiner argued that Hoshizaki et al. at Col. 10, lines 45-50 teaches oxygen gas pressure below atmospheric pressure. (Office Action of March 2, 2007, page 4, lines 10-11) However, unlike claims 1 and 4 (which recite "without substantially changing an oxygen gas pressure"), Hoshizaki et al. disclose a method where the pressure is changed a first through fourth predetermined times. (Hoshizaki et al., column 10, lines 35-60).

One of ordinary skill in the art would not combine the teachings of Hoshizaki et al. or Okamoto et al. with Kobayashi et al. because the method of producing a superconducting wire (from a powdered raw material) disclosed by Kobayashi et al. does not use (and is inconsistent with) film deposition. Kobayashi et al. disclose multiple advantages for using a pressurized atmosphere in order to eliminate voids and blisters that would be formed in the powdered material if the pressure was about 0.4 MPa (4 atm) and would lower critical current density and thus, teaches away from both thin film deposition and using the oxygen gas pressure below atmospheric pressure. (Kobayashi et al., column 1, lines 60-64).

Hoshizaki et al. is not related to superconducting wires, instead, Hoshizaki et al. is primarily concerned with creating integrated circuits (Hoshizaki et al., column 1, lines 45 – 49) or the superconductive thin film used as parts of a high frequency passive element (Hoshizaki et al., column 9, lines 15 – 20). Hoshizaki et al. discloses introducing partial oxygen pressure at least four predetermined times in order to get a orthorhombic system crystal which leads to higher critical temperature. (Hoshizaki et al., column 1 lines 33 to 40).

Therefore due to the fundamental differences between film deposition and using pressurized atmosphere to form superconducting wires, one of ordinary skill in the art would not have found it obvious to combine the teaching of Hoshizaki et al. and Kobayashi et al.

**ii) The base layer having a biaxial orientation**

Claims 1 and 4 recite, among other features, a base layer having a biaxial orientation. (Original specification, page 6 line 8 to page 7, line 7).

References cited in Office Action of March 2, 2007 fail to disclose a portion of a base layer having a biaxial orientation. Instead, Hoshizaki et al. discloses using a substrate 1 made of MgO having a crystal orientation (not biaxial orientation). (Column 4, lines 31-34). Next, Okamoto et al. teaches using a normal conductive layer with a superconducting layer and fails to disclose a biaxial orientation. (Okamoto et al. Abstract and Constitution). Lastly, Kobayashi et al. fail to disclose a base layer and thus, fails to teach or suggest a biaxial orientation of the base layer.

The original specification discloses in detail the structure of the base layer on page 6 line 8 to page 7 line 7 and page 8 lines 4 to line 7 in order to accomplish the goal of achieving high current density ( $J_c$ ) and large critical current ( $I_c$ ).

Since the cited references fail to disclose, suggest or render predictable a base layer having a portion with a biaxial orientation. Claims 1 and 4 are believed to be distinguished over the references of record and allowable.

**iii) A superconductor wire.**

Amended claims 1 and 4 recite a method of producing a superconductor superconducting wire. However, the superconductor as disclosed by Hoshizaki et al. has a critical temperature of 87 k or higher and describes a thickness of 0.5  $\mu\text{m}$  or larger designed for program storage devices (Hoshizaki et al. column 2, lines 54 to 62). Because Hoshizaki et al. describe superconductors for program storage devices, they fail to disclose information relevant to wires such as the critical current. Therefore one of ordinary skill in the art would not look to Hoshizaki et al. for a method of producing a superconductor wires.

Next, Okamoto et al. fail to disclose a superconductor wire. Okamoto et al. describe a composite in which normal conductor layers composed of silver or the like and superconductor layers are alternately disposed. The method of Okamoto et al. may increase current density but Okamoto et al. do not describe a high critical current as recited in new claims 10 and 11.

Lastly, Kobayashi et al. discloses a superconductor formed by filling a metal tube with raw material powder of an oxide superconductor, which is fundamentally different from the thin film method as recited by claim 1 and superconducting wire as recited by claim 4 (film deposition, without substantially changing an oxygen gas pressure and the oxygen gas pressure is below atmospheric pressure). Moreover, the oxygen treatment is performed in order to prevent voids, and the pressure is 1 MPa to 50 MPa, which is greatly different from oxygen gas pressure below atmospheric pressure.

Due to the vastly different procedures described in the various references, one of ordinary skill in the art would not have found it obvious to combine the cited references when trying to achieve the goals of achieving large critical current ( $I_c$ ) and high critical current density ( $J_c$ ). Furthermore, the superconducting wire as formed by claim 1 and the superconducting wire of claim 4 can provide unexpected results of large critical current flows as shown in examples 4 through 9 from 262.5 to 325 A/cm in width), which is not described in any of the cited references. (Original specification Examples 4-9).

In view of the forgoing claims 1 and 4 are not obvious, and thus, are believed to be allowable. Claims 2-11 depend (direct or indirectly) from claims 1 and 4, and thus, are

believed to be allowable for at least the same reasons claims 1 and 4 are believed to be allowable.

**iv) New claims with critical current greater than 250 A/cm.**

In addition, each of new dependent claims 10 and 11 is believed to be further distinguished from the references of record. For example, new claim 10 is dependent on claim 1 and recites that the critical current is at least 250 A/cm in width. New claims 11 is dependent on claim 4 and recites that the critical current is at least 250 A/cm in width. As discussed above, the cited references fail to disclose or suggest a critical current of at least 250 A/cm in width.

**Conclusion:**

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741..

If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date

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